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Chapter Five – Changes in Emissions: All Sources within the State (40 CFR 51.308(g)(4))

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5.1 Status Summary

Table 5-1 shows that emissions of all visibility impairing pollutants decreased from the 2002 baseline inventory to the 2008 comparison year inventory developed by the WRAP, except for fine soil and coarse mass. The increases in fine soil and coarse mass were likely due to updates in inventory development methodologies rather than actual increases. Sections 5.5.7 and 5.5.8. Notably, actual 2008 emissions are lower than the projected 2018 emissions for all pollutants except fine soil and coarse mass. Point source SO_2 emissions alone decreased by 78 percent between the baseline and 2008 inventories (Table 5-5), while NO_x point source emissions decreased by over 50 percent (Table 5-7). This demonstrates a significant reduction in Nevada's anthropogenic emissions of SO_2 and NO_x and confirms the success of Nevada's long-term strategy for reducing emissions that are controllable within the State.

Table 5-1. Comparison of 2002, 2008 and 2018 Emission Inventories for All Visibility Impairing Pollutants*

Pollutants	2002 Baseline (tpy)	2008 Inventory (tpy)	2018 Projection (tpy)	2008 Actuals as a Percent of 2018 Projections
Sulfur Dioxide	67,743	17,058[1]	46,224	37%
Oxides of Nitrogen	162,397	119,513	135,496	88%
Ammonia	12,092	9,382	14,503	65%
Volatile Organic Compounds	897,102	351,142	897,707	39%
Primary Organic Aerosol	24,734	11,816	24,822	48%
Elemental Carbon	6,409	4,425	5,638	78%
Fine Soil	21,208	40,301	24,134	167%
Coarse Mass	161,142	321,257	188,287	171%

* The SO_2 and NO_x data include only gaseous emissions.

5.2 Baseline and Progress Periods for Tracking Emission Changes

40 CFR 51.308(g)(4) requires an analysis tracking the change over the past five years of the emissions of pollutants from all sources and activities within the state that contribute to visibility impairment. This chapter describes the change in emissions between the baseline period and the progress period. In doing so, it relies principally on the WRAP TSD prepared for the western states to support the development of 5-year progress reports. Appendix A and WRAP 2013. The WRAP TSD includes extensive analyses and comparisons of emissions data from source categories, displaying the differences between the baseline and progress period inventories for Nevada.

[1] Nevada over-reported 2008 NEI SO_2 emissions by 88 tons. This correction has been accounted for in Table 5-1.

The baseline period is represented by the 2000-2004 emission inventory developed by the WRAP for use in the initial RH SIPs. The development of the baseline (referred to as "2002" by the WRAP) or "Plan02" inventories was a cooperative effort between the WRAP and the western states. The emissions reported by the states in the 2002 NEI served as the starting point for the Plan02 inventories. The data were enhanced via efforts by contractors, WRAP workgroups, and consultation with the WRAP states. Point, area, mobile, oil and gas, fire and dust source categories were better characterized through this effort. Section 5.3 further describes the development of the Plan02d inventory.

> *51.308(g) Periodic progress reports must contain at a minimum . . .*
> *(4) An analysis tracking the change over the past 5 years in emissions of pollutants contributing to visibility impairment from all sources and activities within the State. Emissions changes should be identified by type of source or activity. The analysis must be based on the most recent updated emissions inventory, with estimates projected forward as necessary and appropriate, to account for emissions changes during the applicable 5-year period.*

The inventory year chosen for comparison with the baseline year is 2008 as provided in the WRAP TSD. WRAP 2013. The WRAP used the 2008 NEI as a starting point, then updated that inventory through its WestJump Air Quality Modeling Study (WestJump AQMS 2013), producing an updated and comprehensive inventory for year 2008. WestJump2008. Section 5.4 further describes the data sources used in developing the 2008 inventory. Emissions data is presented showing the change from the 2008 NEI to the 2011 NEI, where available.

Emission inventories were complicated by the fact that a number of changes and enhancements have occurred between development of the baseline and current period inventories. Thus, some of the differences between inventories are more reflective of changes in methodology, rather than changes in actual emissions. Some examples of the changes include using a revised mobile model, different meteorological models, incorporation of state-specific data, re-categorization of sources into more appropriate source categories, regulatory changes, revised emission rates, and improvements to activity data. The changes and enhancements are discussed more in Section 5.3 of this chapter and Table 3.2-1 of the WRAP TSD. WRAP 2013. These differences in methodologies will affect the ability to make comparisons of inventories used for 2002 and 2008 estimates.

In Nevada's 2009 RH SIP, emission summaries compared both gaseous and particulate emissions of sulfur oxides (SO_x) and NO_x. Emission summaries in the WRAP TSD compared just gaseous emissions of SO_2 and NO_x. The difference between gaseous and particulate emissions and gaseous only emissions for point and area source categories, the primary sources

of SO_2 and NO_x emissions, is less than one percent. For this report, Nevada is conforming to the analysis performed by the WRAP for the TSD. Therefore, a comparison of the gaseous emissions of SO_2 and NO_x is discussed in this chapter.

As evident in Section 5.3, the majority of anthropogenic point source emissions in the baseline period are SO_2 and NO_x. Thus, this chapter focuses on the emission reductions from point sources of SO_2 and NO_x. Table 5-2 lists the different source categories that comprise anthropogenic and natural sources of visibility-impairing pollutants generally.

Table 5-2. Anthropogenic and Natural Source Categories

Anthropogenic Source Categories	Natural Source Categories
Point Sources	Natural Fire Sources
Anthropogenic Fire Sources	Biogenic Sources
Area Sources	Wind Blown Dust
WRAP Oil and Gas Sources	
On-Road Mobile Sources	
Off-Road Mobile Sources	
Road Dust	
Fugitive Dust	

Table 5-3 lists the major emitted pollutants inventoried, the related monitored aerosol species, some of the major sources for each pollutant, and some notes regarding implications of these pollutants. Appendix A, Table 6.8-7

Table 5-3. Pollutants, Aerosol Species and Major Sources

Emitted Pollutant	Related Aerosol	Major Sources	Notes
Sulfur Dioxide (SO_2)	Ammonium Sulfate	Point Sources; On- and Off-Road Mobile Sources	SO_2 emissions are generally associated with anthropogenic sources, such as coal-burning power plants, other industrial sources such as refineries and cement plants, and both on- and off-road diesel engines.
Oxides of Nitrogen (NO_x)	Ammonium Nitrate	On- and Off-Road Mobile Sources; Point Sources; Area Sources	NO_x emissions are generally associated with anthropogenic sources. Common sources include virtually all combustion activities, especially those involving cars, trucks, power plants, and other industrial processes.
Ammonia (NH_3)	Ammonium Sulfate and Ammonium Nitrate	Area Sources; On-Road Mobile Sources	Gaseous NH_3 has implications in particle formation because it can form particulate ammonium. Ammonium is not directly measured by the IMPROVE program, but affects formation potential of ammonium sulfate and ammonium nitrate. All measured nitrate and sulfate is assumed to be associated with ammonium for IMPROVE reporting purposes.
Volatile Organic Compounds (VOCs)	Particulate Organic Mass (POM)	Biogenic Emissions; Vehicle Emissions; Area Sources	VOCs are gaseous emissions of carbon compounds, which are often converted to POM through chemical reactions in the atmosphere. Estimates for biogenic emissions of VOCs have undergone significant updates since 2002, so changes reported here are more reflective of methodology changes than actual changes in

Emitted Pollutant	Related Aerosol	Major Sources	Notes
			emissions. See Section 3.2.1 of the WRAP TSD.
Primary Organic Aerosol (POA)	POM	Wildfires; Area Sources	POA represents organic aerosols that are emitted directly as particles, as opposed to gases. Wildfires in the west generally dominate POA emissions, and large wildfire events are generally sporadic and highly variable from year to year.
Elemental Carbon (EC)	EC	Wildfires; On- and Off-Road Mobile Sources	Large EC events are often associated with large POM events during wildfires. Other sources include both on- and off-road diesel engines.
Fine soil	Soil	Windblown Dust; Fugitive Dust; Road Dust; Area Sources	Fine soil is reported here as the crustal or soil components of $PM_{2.5}$.
Coarse Mass (PMC)	Coarse Mass	Windblown Dust; Fugitive Dust	Coarse mass is reported by the IMPROVE Network as the difference between PM_{10} and $PM_{2.5}$ mass measurements. Coarse mass is not separated by species in the same way that $PM_{2.5}$ is speciated, but these measurements are generally associated with crustal components. Similar to crustal $PM_{2.5}$, natural windblown dust is often the largest contributor to PMC.

5.3 Emissions from the 2002 Baseline Period

The baseline period emissions are represented by the 2002 inventory developed by the WRAP for the initial RH SIPs. This effort built upon 2002 emissions submitted by states to USEPA for the 2002 NEI and incorporated work by contractors and WRAP workgroups in consultation with states. Base02 was the first inventory, which used actual 2002 data and represented actual conditions in calendar year 2002. Subsequent to the Base02 inventory, a series of Plan02 inventories were developed (Plan02a, Plan02b, Plan02c and Plan02d) using 2000 through 2004 data. The purpose of the inventory series was to represent baseline emission patterns based on average, or typical, conditions rather than a single year. The Plan02d emission inventory was a result of minor changes to the Plan02c inventory. The Plan02d inventory provides the basis in this report for comparison with the 2018 projected emissions, as well as for gauging reasonable progress with respect to future year visibility.

Data comparisons were made between the baseline and 2008 emission inventory periods for nine source categories. A summary of the emission inventory descriptions for the Plan02d source categories follows. A more detailed description can be found in the WRAP TSD. WRAP 2013, Table 3.2-1.

1. Point source inventory –This inventory was generated using hourly USEPA CAMD continuous emission monitoring (CEM) data for EGUs. Other point source emissions were developed in consultation with states.

2. Area source inventory –This inventory was developed by the WRAP contractor, Eastern Research Group, in consultation with states.
3. Area oil and gas – The oil and gas inventories were developed for specific oil and gas basins using WRAP Phase II emissions methodologies. If Phase II emission methodologies were not available, then state-reported emissions were used. Nevada did not report oil and gas emissions. However, Nevada was included in the Phase II oil and gas inventory; therefore emissions for the baseline period for Nevada exist.
4. On-road mobile – This inventory was generated using USEPA's MOBILE6 model as applied by ENVIRON using inputs from states.
5. Off-road mobile – This inventory was generated using NONROAD2004 model as applied by ENVIRON using inputs from states.
6. Fugitive dust and road dust – This inventory was generated using the WRAP 2002 inventory by ENVIRON with initial inputs from states. Vegetative scavenging factors were applied pre-processing at the county level, as opposed to grid-level for 2008 data.
7. Windblown dust – This inventory was generated using the WRAP Windblown Dust Model and the 2002 Meteorological Mesoscale 5 (MM5) gridded meteorological data at 36 km grid cell resolution. Vegetative scavenging factors were applied pre-processing at the county level, versus post-processing at the grid cell level for 2008.
8. Biogenic – This inventory was generated using BEIS3.12 model, BELD3 land use and 2002 MM5 meteorological data, at 36 km grid cell resolution.
9. Fires (natural and anthropogenic) – This inventory was generated using the WRAP's Phase III fire inventory, which represented a 5-year average of fire activity from 2000 to 2004.

Table 5-4 provides Nevada emissions data by pollutant from the Plan02d baseline inventory. Point sources contribute 32 percent of the total anthropogenic emissions. Of that 32 percent, SO_2 and NO_x emissions account for 92 percent of the anthropogenic point source emissions and 29 percent of total anthropogenic emissions. Clearly, SO_2 and NO_x emissions from point sources are the primary, controllable visibility impairing pollutants in the baseline inventory.

Table 5-4. Emissions from Plan02d Baseline Inventory in Tons

Plan02d	Point Source Anthropogenic Emissions	Total Anthropogenic Emissions	Total Natural Emissions (fire + biogenic + dust)
SO_2	50,720	65,543	2,200
NO_x	59,864	139,353	23,044
NH_3	339	10,408	1,684
VOC	2,215	85,357	811,745

POA	256	2,233	22,501
EC	13	1,735	4,674
Fine Soil	2,158	9,364	11,845
Coarse Mass	4,093	62,020	99,122
Total	119,658	376,013	976,815

5.4 Emissions from the 2008 Progress Period

The progress period is represented by the WRAP's WestJump2008 inventory. Data comparisons were made between the baseline and 2008 emission inventory periods for Nevada in nine different source categories. The WRAP continues to refine inventories and conduct studies to better estimate emissions from the different source categories. A summary of the sources of data used for each source category for the progress period follows; a more detailed description of the inventories used in developing the WestJump2008 inventory can be found in the WRAP TSD. WRAP 2103, Table 3.2-1. When different models or data sources were used in the 2008 inventory as compared to the baseline inventory, those differences are noted below.

1. Point source – The WRAP WestJump2008 inventory was generated using hourly USEPA CAMD CEM data for EGUs. WestJump AQMS 2013. Other point sources emissions are from the 2008 NEI v2. Point source oil and gas inventories were inventoried separately for WestJump2008 and are included in this point source inventory.
2. Area source – The area source category is now referred to as the "non-point" emission sector category by USEPA. WRAP's WestJump2008 inventory used state-reported area source inventories from the 2008 NEI v2. The WRAP included stationary area sources, agricultural and natural ammonia emission sources, oil and gas production operations, and biogenic emissions for the non-point sector in addition to the typical area source emission categories.[2] Beginning in 2008, some sources that were previously considered "off-road" were incorporated into the area source inventory, i.e., commercial marine vessels, vessels on in-land waterways and in-transit locomotive emissions. For the WestJump2008 inventory, area oil and gas emissions were reported separately.
3. Area oil and gas – The oil and gas inventories were developed for specific oil and gas basins using WRAP Phase III emission methodologies, based on Version 2.0 of the 2008 NEI. Twelve additional categories were included for the 2008 progress period than were used in the 2002 baseline inventory. New emission methodologies, especially for VOC emission rates, were used. If WRAP Phase III emissions methodologies were not available, area source oil and gas emissions as reported by the states to the 2008 NEI were used. Nevada did not report oil and gas emissions to the 2008 NEI. Furthermore,

[2] TSS Stationary Area Source Emissions June 2011.doc (last viewed 5/21/2014), located on the TSS website, http://vista.cira.colostate.edu/docs/wrap/emissions.

since Nevada was not included in the oil and gas basins for the WestJump study, there were no estimates for 2008 oil and gas emissions for Nevada.

4. On-road mobile – USEPA's Motor Vehicle Emission Simulator (MOVES) 2010 model was applied to state inputs. Inputs were updated with new Vehicle Miles Traveled (VMT) and controls on vehicles.
5. Off-road mobile – The 2008 off-road mobile inventory was obtained from the 2008 NEI v2, using NONROAD model estimates from within the National Mobile Inventory Model. One important methodology change was the reclassification of some sources previously labeled off-road; these sources were included in the non-point (area) sources in 2008.
6. Fugitive dust and road dust –These emissions were extracted from state-reported area source estimates from the 2008 NEI v2. Vegetative scavenging factors were applied post-processing at a higher resolution grid cell level than for the 2002 data.
7. Windblown dust – Emissions were generated using the WRAP Windblown Dust Model and a different meteorological model, 2008 WRF, at 4 km and 12 km grid cell resolution versus 36 km resolution in the baseline period. There were significant updates to enhance the accuracy of the WRAP Windblown Dust Model; thus, it will affect comparisons between the baseline period and the 2008 inventory. Vegetative scavenging factors were applied post-processing at the grid cell level rather than pre-processing at the county level for 2002. The WestJump AQMS project included many technical updates and improvements including refinements to the grid, meteorology and land-cover data thus improving the data results for the dust modeling. The study on dust emission sources for the WestJump AQMS was presented as Technical Memorandum No. 6: Dust Source Emissions.[3]
8. Biogenic – A different model, Model of Emissions of Gases and Aerosols from Nature (MEGAN) 2.10, was used along with different meteorology data, 2008 WRF, at a finer grid cell resolution, 4 km and 12 km.
9. Fires (natural and anthropogenic) – The WRAP used DEASCO3[4] fire summaries to account for fires in 2008 rather than a 5-year average of fires as was used in the baseline inventory. The tables in this report compare fire inventories between the baseline period, a five-year average from 2000-2004, and 2008, one-year of data from the DEASCO3 study, although this results in a somewhat misleading comparison. There was separate reporting of anthropogenic and natural fires.

[3] http://wrapair2.org/pdf/Memo6_Dust_Mar11_2013review_draft.pdf (last viewed 5/21/2014)
[4] "Deterministic and Empirical Assessment of Smoke's Contribution to Ozone," https://deasco3.wraptools.org/ (last viewed 5/20/2014)

5.5 Emission Differences between the Baseline and Progress Periods

This section analyzes the change in emissions between the baseline (Plan02d) and 2008 (WestJump2008) inventories and includes comparison of some source category changes between the 2008 and 2011 NEIs. As noted earlier in this report, a number of changes and enhancements have occurred between development of the baseline and current period inventories. Where such changes in methodology affect the 2008 data, they are identified in the following discussion.

The data by source type are shown below for the following emission species: sulfur dioxide, oxides of nitrogen, ammonia, volatile organic compounds, primary organic aerosol, elemental carbon, fine soil and coarse mass.

5.5.1 Sulfur Dioxide

Table 5-5 shows SO_2 emissions by source category for the baseline and 2008 inventories. Table 5-6 presents 2008 and 2011 NEI data for the point and mobile source categories. The primary source of SO_2 in Nevada is from point sources. Nevada's point sources contribute 75 percent of total (anthropogenic and natural) statewide SO_2 emissions in the Plan02d inventory and 65 percent of total statewide SO_2 emissions in the WestJump2008 inventory. Point source SO_2 emissions alone decreased by 78 percent between the 2002 and 2008 inventories. The NEI point source inventory shows a further decrease of 44 percent in SO_2 emissions from 2008 to 2011 (Table 5-6).[5] Area source SO_2 emissions decreased 63 percent from 2002 to 2008. Due to the complexity of the calculation of the area source emissions, there are no area (aka non-point) emissions obtained directly from the NEI.

Table 5-5. Sulfur Dioxide Emissions by Category

Source Category	Sulfur Dioxide Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	50,720	11,067[6]	-39,653
Area	12,953	4,863	-8,090
On-Road Mobile	454	298	-156
Off-Road Mobile	1,403	322	-1,081
Area Oil and Gas	0	0	0
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	12	2	-10
Total Anthropogenic	65,543	16,552	-48,991 (-75%)
Natural Sources			

[5] Note that the 2008 NEI emissions are slightly different from the WestJump2008 inventory, which leverages more recent inventory development work performed by the WRAP.

[6] Nevada over- reported 2008 NEI SO_2 point emissions by 88 tons, due to incorrect emission unit and transcription errors. This correction has been accounted for in Table 5-5 and Table 5-6.

Natural Fire	2,200	506	-1,694
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	2,200	506	-1,694 (-77%)
All Sources			
Total Emissions	67,743	17,058	-50,685 (-75%)

On-road mobile source SO_2 emissions decreased 34 percent from the Plan02d to the WestJump2008 inventory, while the NEI data show a further 47 percent decrease from 2008 to 2011. Off-road mobile source SO_2 emissions decreased by 77 percent from the Plan02d inventory to WestJump2008 inventory and 87 percent from 2008 to 2011 based on the NEI.

In sum, Table 5-5 shows all source categories of SO_2 decreased between the Plan02d and WestJump2008 inventories. Total anthropogenic and total anthropogenic plus natural emissions both saw a net decrease of 75 percent between the Plan02d and WestJump2008 emission inventories. The large reduction of SO_2 emissions for point sources is primarily due to the closure of Mohave in southern Nevada. The reductions in SO_2 emissions from mobile sources are likely due to the required use of low sulfur diesel fuel discussed in Chapter Three, Section 3.3.

There is a significant decrease in SO_2 emissions from point and mobile sources in the 2008 and 2011 NEI (Table 5-6). This is primarily due to reductions in coal-fired power plant emissions, as discussed in Chapter Three, as well as reductions from on-road and off-road mobile source emissions.

Table 5-6. SO_2 NEI Emissions (2008 and 2011)

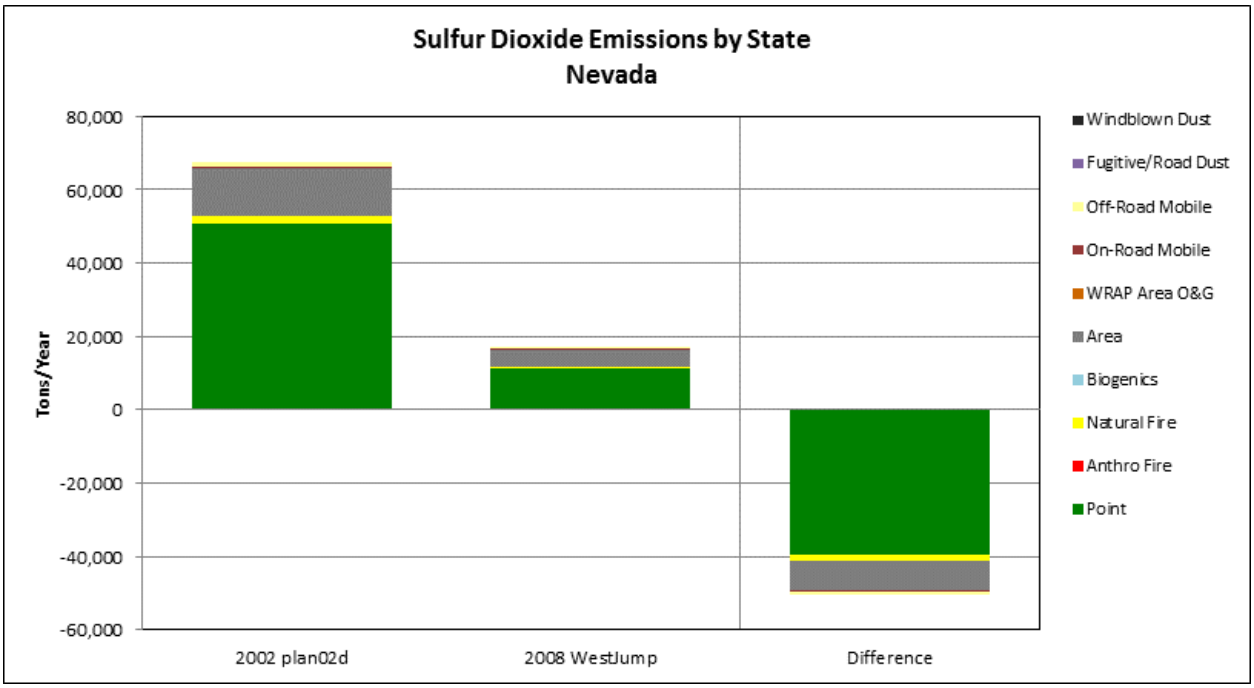
Source Category	SO_2 Emissions (tons/year)	
	2008 NEI	2011 NEI (% change from 2008)
Point	10,409[7]	5,863[8] (-44%)
On-Road Mobile	511	270 (-47%)
Off-Road Mobile	316	41 (-87%)

Figure 5-1 presents a graphical display of the difference in SO_2emissions by source category for the baseline period and the current progress period from the WRAP TSD. Appendix A. While there are significant reductions in SO_2 emissions from both area and point sources, the reduction from point sources is especially noteworthy.

[7] See supra n.7.

[8] Nevada under-reported 2011 NEI SO_2 point emissions by 427 tons, due to incorrect emission unit and transcription errors. This correction has been accounted for in Table 5-6. SO_2 NEI Emissions (2008 and 2011)

Figure 5-1. 2002 and 2008 Sulfur Dioxide Emissions and Differences by Source Category



5.5.2 Oxides of Nitrogen

Table 5-7 shows NO_x emissions by source category for the baseline and 2008 inventories; Table 5-8 presents 2008 and 2011 NEI data for the point and mobile source categories. The primary anthropogenic source categories of NO_x emissions in Nevada are point and on-road mobile, followed by off-road mobile, and area sources. Nevada's point sources contribute 37 percent of total statewide NO_x emissions in the Plan02d inventory, decreasing to 25 percent in the WestJump2008 inventory. Point source emissions alone decreased by over 50 percent between the 2002 and 2008 inventories. The NEI point source inventory shows a decrease of 57 percent in NO_x emissions from 2008 to 2011.

NO_x emissions from on-road mobile sources increased 22 percent from the Plan02d to the WestJump2008 inventory. The increase can be attributed in part to the use of a different model to estimate on-road mobile emissions. MOBILE6 was used for the 2002 baseline inventory, whereas a new model, MOVES2010, was used for the 2008 progress period. The MOVES2010 model results in higher overall NO_x and $PM_{2.5}$ emissions, but lower VOC emissions.[9] The increase may also be partly due to a growth in the vehicle population, coupled with the fact that reductions from the federal vehicle emission standards have not yet been fully realized (see Chapter Two). Four Nevada counties, comprising nearly three-quarters of the State's population, contributed over 70 percent of the increase: Clark County, 28 percent; Elko County, 18 percent; Pershing County, 12 percent; and Humboldt County, 12 percent. http://nvdemography.org/data-

[9] Introduction to MOVES for Non-Modelers, August 2012, http://www.dvrpc.org/NTAQS/pdf/MOVES_training.pdf

and-publications/, 2008 data. NEI data show a 36 percent increase in on-road mobile NO_x emissions from 2008 to 2011, possibly related to a 2 percent population growth in Clark County and 3 percent in Washoe County.

Off-road mobile source emissions contribute 20 percent of total statewide NO_x emissions in the Plan02d inventory, decreasing to 14 percent in the WestJump2008 inventory. Off-road mobile source emissions alone decreased by 48 percent. NEI data also show a decrease in off-road mobile emissions from 2008 to 2011 of 12 percent (Table 5-8).

Overall, in the progress period 2002 to 2008, total anthropogenic emissions of NO_x in Nevada decreased by 23 percent (Table 5-7 and Figure 5-2). Total NO_x emissions saw a net decrease of 26 percent between the Plan02d and WestJump2008 emission inventories. Increases in on-road mobile and area source inventory totals were offset by larger decreases in point and off-road mobile totals. The increase in emissions for area sources from the 2002 to the 2008 inventory may be a result of a reclassification of some off-road mobile sources into the area source category. This reclassification may have also contributed to the decrease in the emissions for the off-road inventory totals.

Table 5-7. Oxides of Nitrogen Emissions by Category

Source Category	Oxides of nitrogen Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	59,864	29,344[10]	-30,520
Area	5,725	11,321	5,597
On-Road Mobile	41,089	50,068	8,979
Off-Road Mobile	32,565	17,081	-15,484
Area Oil and Gas	63	0	-63
Fugitive and Road Dust	0	0	0
Anthropogenic Fire	48	13	-35
Total Anthropogenic	139,353	107,827	-31,526 (-23%)
Natural Sources			
Natural Fire	8,026	3,575	-4,451
Biogenic	15,018	7,364	-7,654
Wind Blown Dust	0	0	0
Total Natural	23,044	10,939	-12,105 (-53%)
All Sources			
Total Emissions	162,397	118,766[11]	-43,631 (-26%)

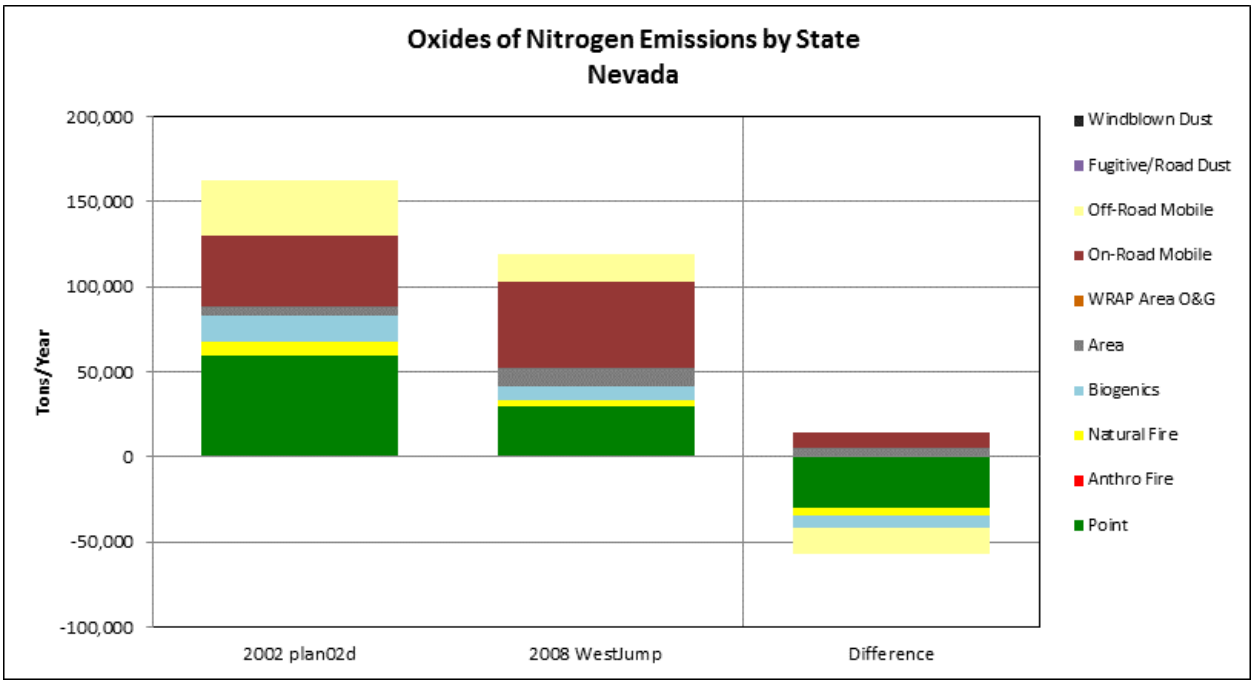
[10] Nevada over-reported 2008 NEI NO_x emissions by 746 tons, due to incorrect emission unit and transcription errors. This correction has been accounted for in Table 5-7 and Table 5-8.
[11] See supra n. 10.

Table 5-8. NOx NEI Emissions (2008 and 2011)

Source Category	NOx Emissions (tons/year)	
	2008 NEI	2011 NEI (% change from 2008)
Point	20,934[12]	10,548[13] (-50%)
On-Road Mobile	40,643	55,389 (36%)
Off-Road Mobile	16,797	14,706 (-12%)

Figure 5-2 shows a graphical display of the difference in NO_x emissions by source category for the baseline period and the current progress period from the WRAP TSD. Appendix A. The reduction in emissions from point and off-road mobile sources is noteworthy.

Figure 5-2. 2002 and 2008 Oxides of Nitrogen Emissions and Differences by Source Category



5.5.3 Ammonia

Table 5-9 shows NH_3 emissions by source category, and Figure 5-3 shows the graphical display from the WRAP TSD. Appendix A. The primary source of anthropogenic emissions of NH_3 in Nevada is from area sources, while natural fire is the dominant natural source of NH_3 emissions.

[12] See supra n. 10.
[13] Nevada under-reported 2011 NEI NO_x point emissions by 1,494 tons, due to incorrect emission unit and transcription errors. This correction has been accounted for in Table 5-8.

Nevada's area sources contribute 66 percent of total statewide NH_3 emissions in the Plan02d inventory and 61 percent of total NH_3 emissions in the WestJump2008 inventory. Area sources of NH_3 emissions alone decreased by 29 percent between the Plan02d and WestJump2008 inventories.

On-road mobile sources showed a notable 58 percent decrease in NH_3 emissions between the 2002 and 2008 inventories. On-road mobile sources contribute 17 percent of total statewide NH_3 emissions in the Plan02d inventory and nine percent in the WestJump2008 inventory. Natural fire contributes 14 and 27 percent in the 2002 and 2008 inventories, respectively.

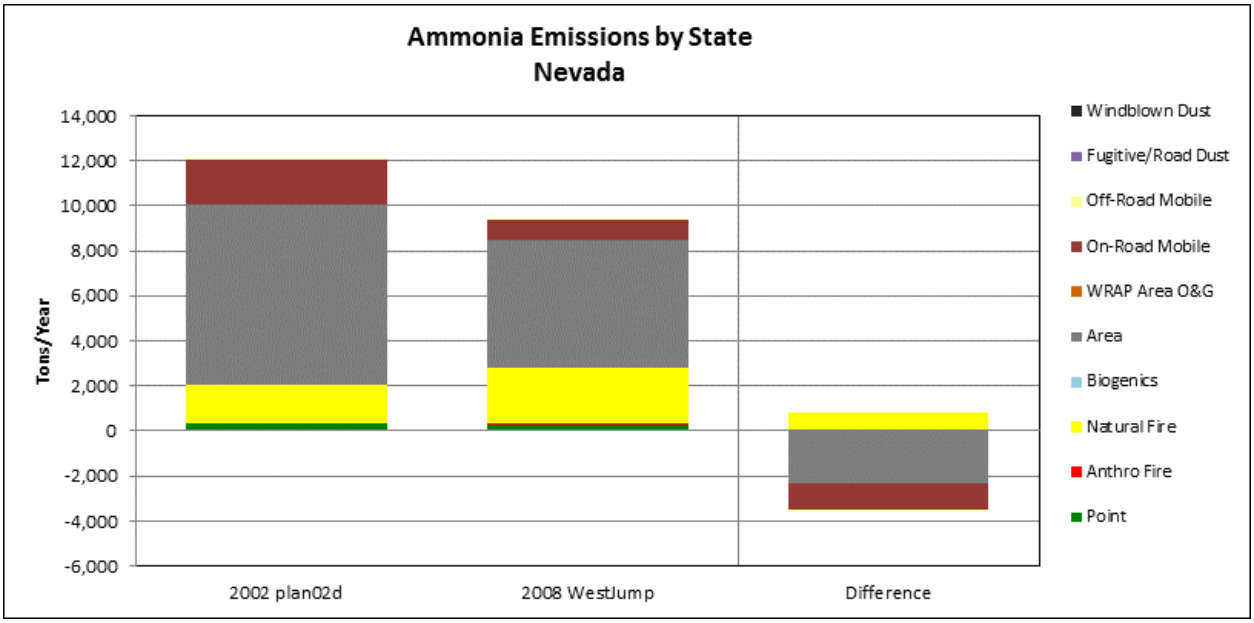
In sum, all anthropogenic source categories of NH_3 decreased between the Plan02d and WestJump2008 inventories. Total anthropogenic emissions of NH_3 saw a net decrease of 34 percent between the Plan02d and WestJump2008 emission inventories. In spite of the fact that emissions from natural fires increased by almost 50 percent, total NH_3 emissions still decreased by a net of 22 percent.

Ammonia is not a criteria pollutant and is not inventoried or reported to the NEI; thus, no NEI emissions data for NH_3 is provided.

Table 5-9. Ammonia Emissions by Category

Source Category	Ammonia Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	339	302	-37
Area	8,009	5,717	-2,293
On-Road Mobile	2,030	849	-1,182
Off-Road Mobile	22	20	-2
Area Oil and Gas	0	0	0
Fugitive and Road	0	0	0
Anthropogenic Fire	8	6	-2
Total Anthropogenic	10,408	6,893	-3,515 (-34%)
Natural Sources			
Natural Fire	1,684	2,490	805
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	1,684	2,490	805 (48%)
All Sources			
Total Emissions	12,092	9,382	-2,710 (-22%)

Figure 5-3. 2008 and 2008 Ammonia Emissions and Differences by Source Category



5.5.4 Volatile Organic Compounds

Table 5-10 shows VOC emissions by source category; Table 5-11 presents 2008 and 2011 NEI data for the point and mobile source categories. Figure 5-4 shows a graphical display from the WRAP TSD. Appendix A. The data show huge reductions in VOC emissions from natural sources with lesser reductions from anthropogenic sources. Biogenic emissions from natural sources dominate the Nevada VOC emissions inventory.

VOC emissions showed a 61 percent decrease overall, mostly due to a decrease in the biogenic emission inventory (67 percent). However, estimates for biogenic emissions of VOCs have undergone significant updates since 2002, hence changes reported here are more reflective of enhancements in the inventory methodology rather than actual changes in emissions. Table 5-3. Specifically, the Plan02d inventory used the BEIS3.12 model, while the WestJump2008 inventory used the MEGAN2.10 model outputs. Also, different meteorological years were used, 2002 MM5 for the Plan02d inventory and 2008 WRF for the WestJump2008 inventory. In addition, higher temporal and spatial variability of land cover and improved emission factors based on better sources of data (e.g., satellites and field studies) were used for the WestJump2008 inventory.

There were also decreases in the on-road mobile, natural fire and anthropogenic fire source categories. The decrease in on-road mobile emissions of VOCs is partly due to the use of different models. MOBILE6 was used for the Plan02d inventory, while MOVES2010 was used for 2008. There were also new VMT data and new controls on vehicles (WRAP 2013, Table 3.2-1), which may account for some of the decrease in emissions. Specifically, VOC emissions are reduced due to implementation of the Tier 2 Vehicle and Gasoline Sulfur Program discussed Chapter Two.

For natural fire emissions, a detailed and comprehensive inventory was conducted for year 2008 in the DEASCO$_3$ study.[14] VOC emissions decreased significantly in the WestJump2008 inventory. However, only fire emissions from a single year (2008) are represented here for the progress period. Thus, not all fire events for the 2005-2009 period are represented in the WestJump2008 inventory. Due to the variability and sporadic nature of wildfire, a comparison between these inventories is complicated.

Table 5-10. Volatile Organic Compound Emissions by Category

Source Category	Volatile Organic Compound Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point	2,215	2,530[15]	338
Area	28,592	40,973	12,381
On-Road Mobile	36,257	21,302	-14,955
Off-Road Mobile	18,094	18,783	688
Area Oil and Gas	129	0	-129
Fugitive and Road	0	0	0
Anthropogenic Fire	70	16	-54
Total Anthropogenic	85,357	84,026	-1,331 (-2%)
Natural Sources			
Natural Fire	17,606	4,204	-13,403
Biogenic	794,139	262,912	-531,227
Wind Blown Dust	0	0	0
Total Natural	811,745	267,115	-544,630 (-67%)
All Sources			
Total Emissions	897,102	351,142	-545,960 (-61%)

Table 5-11 shows a decrease in point source, on-road mobile and off-road mobile emissions of VOC from the 2008 NEI to the 2011 NEI of 17 percent, 20 percent and 18 percent, respectively.

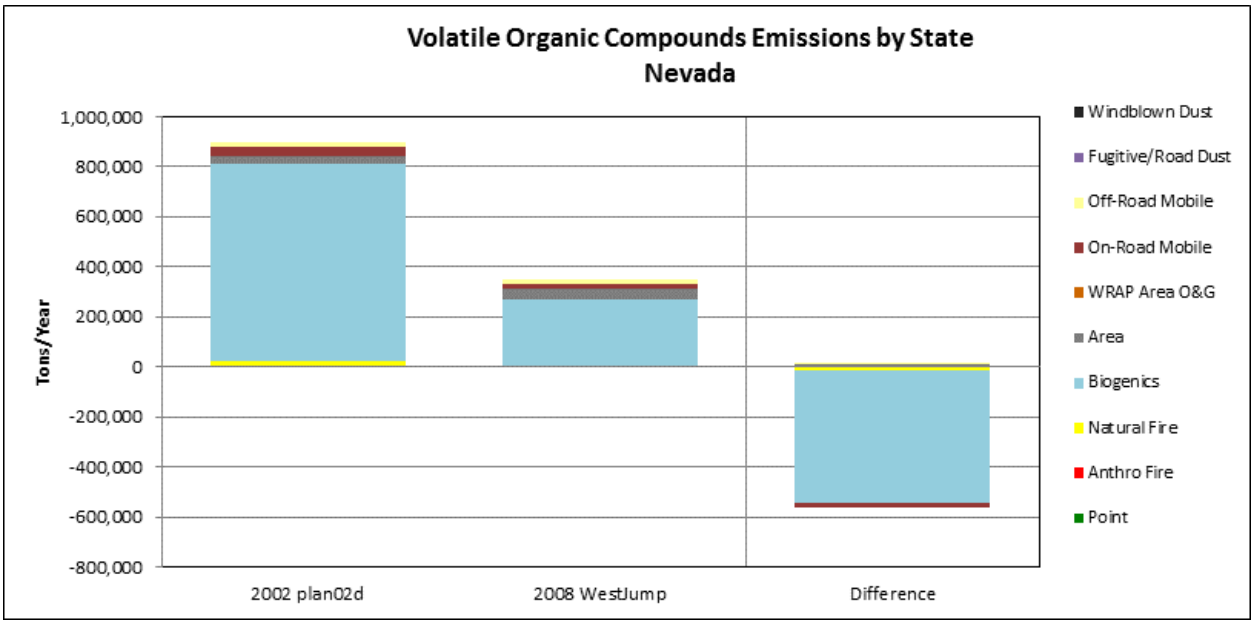
[14] See supra n. 4.

[15] Nevada over-reported NEI 2008 VOC point emissions by 423 tons, due to incorrect emission unit and transcription errors. This correction has been accounted for in Table 5-10 and Table 5-11.

Table 5-11. VOC NEI Emissions (2008 and 2011)

Source Category	VOC Emissions (tons/year)	
	2008 NEI	2011 NEI (% change from 2008)
Point	1,176[16]	971[17] (-17%)
On-Road	27,084	21,779 (-20%)
Off-Road	18,759	15,328 (-18%)

Figure 5-4. 2002 and 2008 Volatile Organic Compounds Emissions and Differences by Source Category



5.5.5 Primary Organic Aerosol

Table 5-12 shows primary organic aerosol emissions by source category, and Figure 5-5 shows the graphical display from the WRAP TSD. Appendix A. Wildfires dominate the primary organic aerosol emissions for both the Plan02d and WestJump2008 inventories at 90 percent and 58 percent, respectively, although anthropogenic sources (area and mobile) are also an important component of the inventory. Large wildfire events are generally sporadic and highly variable from year to year. This variability is seen in the large reduction of primary organic aerosol natural fire emissions between the Plan02d and WestJump2008 inventory years.

[16] See supra n. 15.
[17] Nevada under-reported NEI 2011VOC point emissions by 746 tons, due to incorrect emission unit and transcription errors. This correction has been accounted for in Table 5-11.

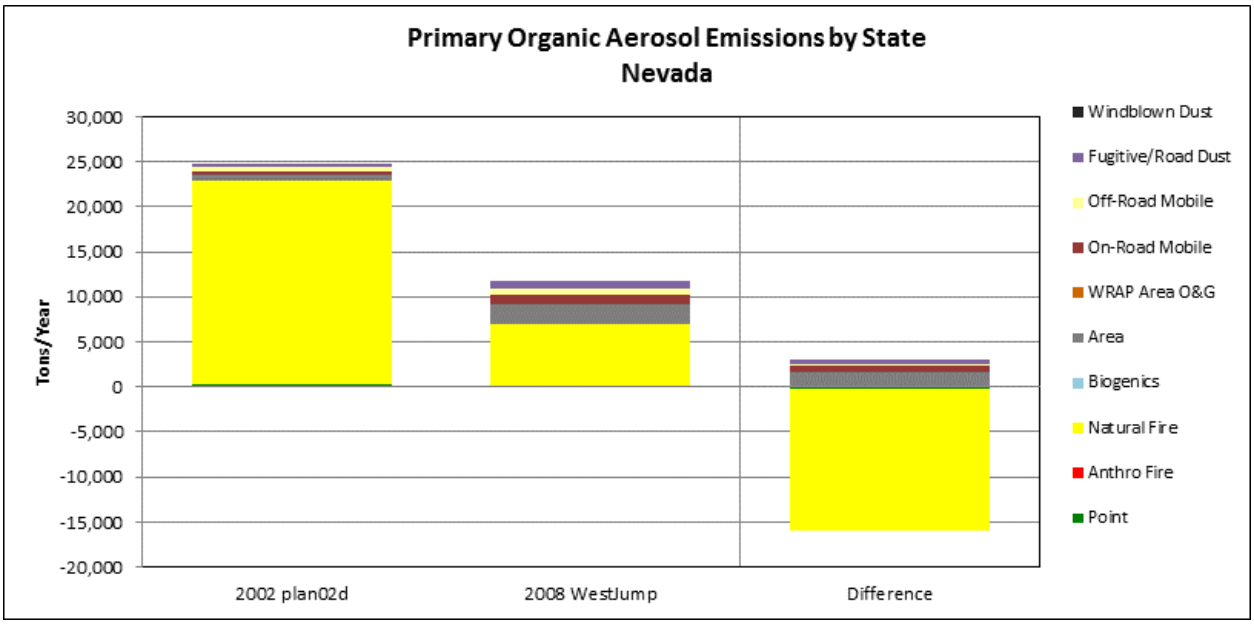
Overall, total emissions of primary organic aerosols decreased by 52 percent from the Plan02d to the WestJump2008 inventory. Point source emissions of primary organic aerosols decreased by 82 percent over that period. While source categories other than natural and anthropogenic fires and point sources saw increases in primary organic aerosol emissions, the total percentage of the other sources is eight percent and 42 percent of the total (anthropogenic plus natural) emissions for the Plan02d and WestJump2008 inventories, respectively. The increase in area emissions is explained in Section 5.4; beginning in 2008, some sources that were previously considered "off-road" were incorporated into the area source inventory. Clark and Washoe Counties, comprising 87 percent of the State population (http://nvdemography.org/data-and-publications/, 2008 data), contribute over 75 percent to total area emissions and 63 percent to total on-road emissions in the WestJump2008 inventory.

Table 5-12. Primary Organic Aerosol Emissions by Category

Source Category	Primary Organic Aerosol Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point*	256	46	-210
Area	687	2,283	1,596
On-Road Mobile	314	1,053	739
Off-Road Mobile	572	689	117
Area Oil and Gas	0	0	0
Fugitive and Road	332	891	559
Anthropogenic Fire	73	22	-51
Total Anthropogenic	2,233	4,985	2,752 (123%)
Natural Sources			
Natural Fire	22,501	6,831	-15,670
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	22,501	6,831	-15,670 (-70%)
All Sources			
Total Emissions	24,734	11,816	-12,918 (-52%)

*Point source data includes only oil and gas and regulated CEM sources. More comprehensive point source data were not available at the time this report was prepared but will be made available through the WRAP TSS (http://vista.cira.colostate.edu/tss/).

Figure 5-5. 2002 and 2008 Primary Organic Aerosol Emissions and Differences by Source Category



5.5.6 Elemental Carbon

Table 5-13 shows elemental carbon emissions by source category, and Figure 5-6 shows the graphical display from the WRAP TSD. Appendix A. Wildfires dominated elemental carbon emissions for the Plan02d inventory at 73 percent. Large wildfire events are generally sporadic and highly variable from year to year. Thus, variability is seen in the elemental carbon emissions from natural fire between the Plan02d and WestJump2008 inventory years.

Total elemental carbon emissions showed a 31 percent decrease between 2002 and 2008. This was mostly due to a 76 percent decrease in emissions from natural fire. On-road mobile, area and point source emissions increased from 2002 to 2008. On-road mobile sources dominated the elemental carbon emissions for the WestJump2008 inventory at 43 percent, while wildfires contributed 26 percent. Area and point source emissions contribute less than one percent each to the 2008 inventory.

Clark County and Washoe County, comprising 87 percent of the State population (http://nvdemography.org/data-and-publications/, 2008 data), are the biggest contributors to the area and on-road mobile emissions for the 2008 inventory. In the area source category, Clark County's contribution is 29 percent and Washoe County's contribution is 17 percent. In the on-road source category, Clark County's contribution is 43 percent and Washoe County's contribution is 16 percent.

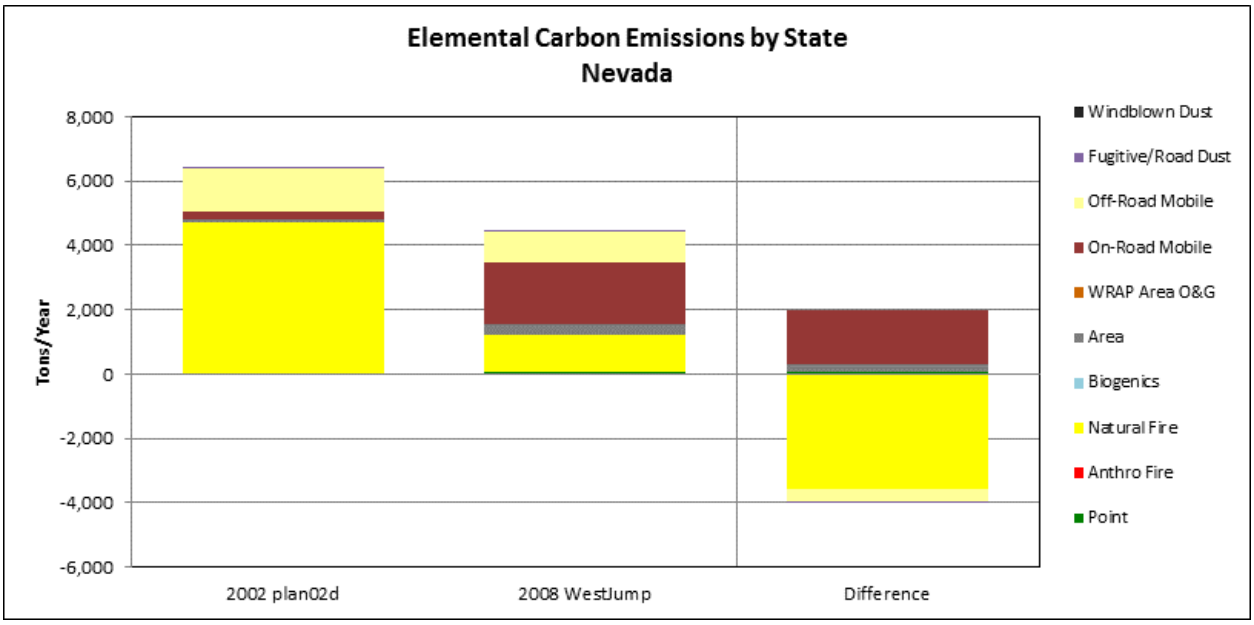
Table 5-13. Elemental Carbon Emissions by Category

Source Category	Elemental Carbon Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point*	13	64	51[18]
Area	96	368	272
On-Road Mobile	235	1,891	1,656
Off-Road Mobile	1,354	954	-400
Area Oil and Gas	0	0	0
Fugitive and Road	24	14	-10
Anthropogenic Fire	13	6	-7[19]
Total Anthropogenic	1,735	3,295	1,560 (90%)[20]
Natural Sources			
Natural Fire	4,674	1,130	-3,544
Biogenic	0	0	0
Wind Blown Dust	0	0	0
Total Natural	4,674	1,130	-3,544 (-76%)
All Sources			
Total Emissions	6,409	4,425	-1,984 (-31%)

*Point source data includes only oil and gas and regulated CEM sources. More comprehensive point source data were not available at the time this report was prepared, but will be made available through the WRAP TSS (http://vista.cira.colostate.edu/tss/).

[18] Note values in Table 5-13 are different than in the WRAP TSD, due to rounding.
[19] See supra n. 18.
[20] See supra n. 18.

Figure 5-6. 2002 and 2008 Elemental Carbon Emissions and Differences by Source Category



5.5.7 Fine Soil

Table 5-14 shows fine soil emissions by source category, and Figure 5-7 shows the graphical display from the WRAP TSD. Appendix A. Fine soil emissions were identified as PM fine emissions in the 2009 RH SIP. Fine soil emissions inventories show increases in fugitive dust and natural windblown dust from the Plan02d to the WestJump2008 inventory. These increases are likely due to updates in inventory development methodologies rather than actual increases. Appendix A, p. 6-2.

Table 5-14. Fine Soil Emissions by Category

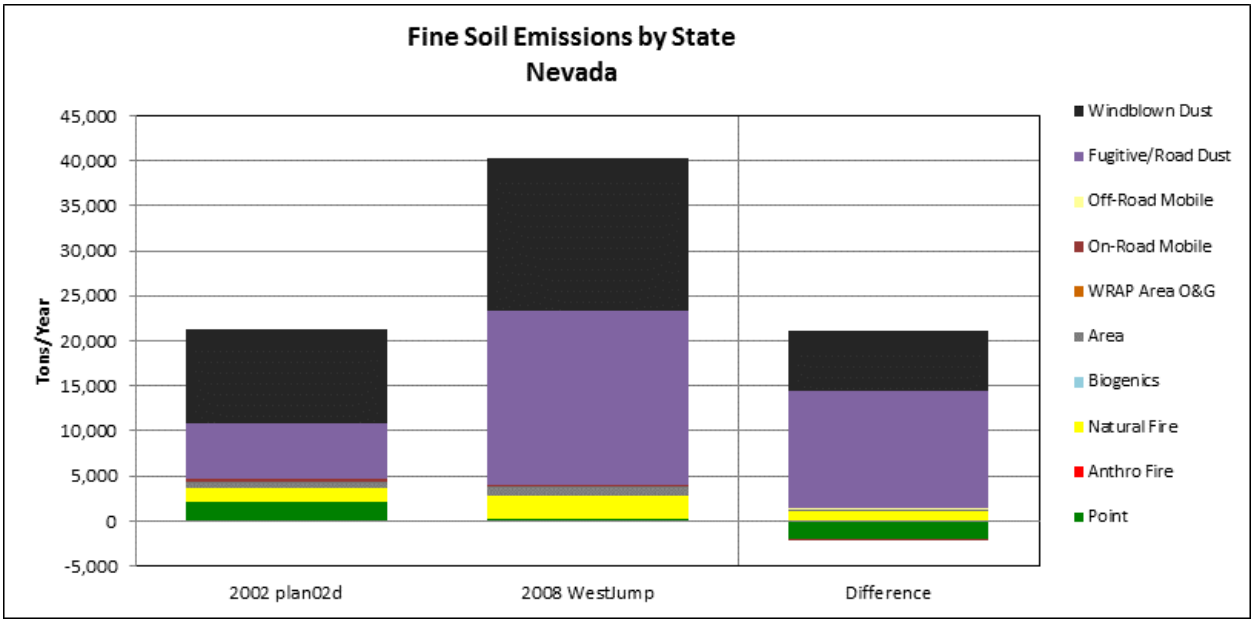
Source Category	Fine Soil Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point*	2,158	209	-1,948
Area	830	1,024	195
On-Road Mobile	239[21]	190	-49
Off-Road Mobile	0	49	49
Area Oil and Gas	0	0	0
Fugitive	6,128	19,216	13,087
Anthropogenic Fire	9	10	1

[21] Fine soil emissions showed zero emissions for the on-road source category in the 2009 RH SIP. This was strictly an oversight and has been corrected here.

Source Category	Fine Soil Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Total Anthropogenic	9,364	20,698	11,334 (121%)
Natural Sources			
Natural Fire	1,406	2,552	1,146
Biogenic	0	0	0
Wind Blown Dust	10,438	17,051	6,613
Total Natural	11,845	19,603	7,758 (65%)
All Sources			
Total Emissions	21,208	40,301	19,092 (90%)

*Point source data includes only oil and gas and regulated CEM sources. More comprehensive point source data were not available at the time this report was prepared but will be made available through the WRAP TSS (http://vista.cira.colostate.edu/tss/).

Figure 5-7. 2002 and 2008 Fine Soil Emissions and Differences by Source Category



5.5.8 Coarse Mass

Table 5-15 shows coarse mass emissions by source category, and Figure 5-8 shows the graphical display from the WRAP TSD. Appendix A. Coarse mass emissions were identified as PM coarse emissions in the 2009 RH SIP. Coarse mass emission inventories showed increases in fugitive and road dust and natural windblown dust from the Plan02d to the WestJump2008 inventory. Fugitive dust includes sources such as agricultural operations, construction and mining operations and windblown dust from vacant lands. These increases in part can be attributed to updates in inventory development methodologies rather than actual increases. Appendix A, p. 6-2. However, increases in the fugitive dust inventories may also be due to increases in population, while increases in road dust may be due to increases in estimated VMT.

The WestJump2008 inventory for coarse mass emissions is dominated by emissions in Clark and Elko Counties at 61 percent and 13 percent, respectively. In Clark County, particulate air pollution is largely associated with windblown dust, re-entrained road dust, or construction activities.[22] The windblown dust category includes more of the natural influences such as wind erosion on natural lands. While point source and natural fire emissions decreased, most of the other sources of coarse mass showed emission increases.

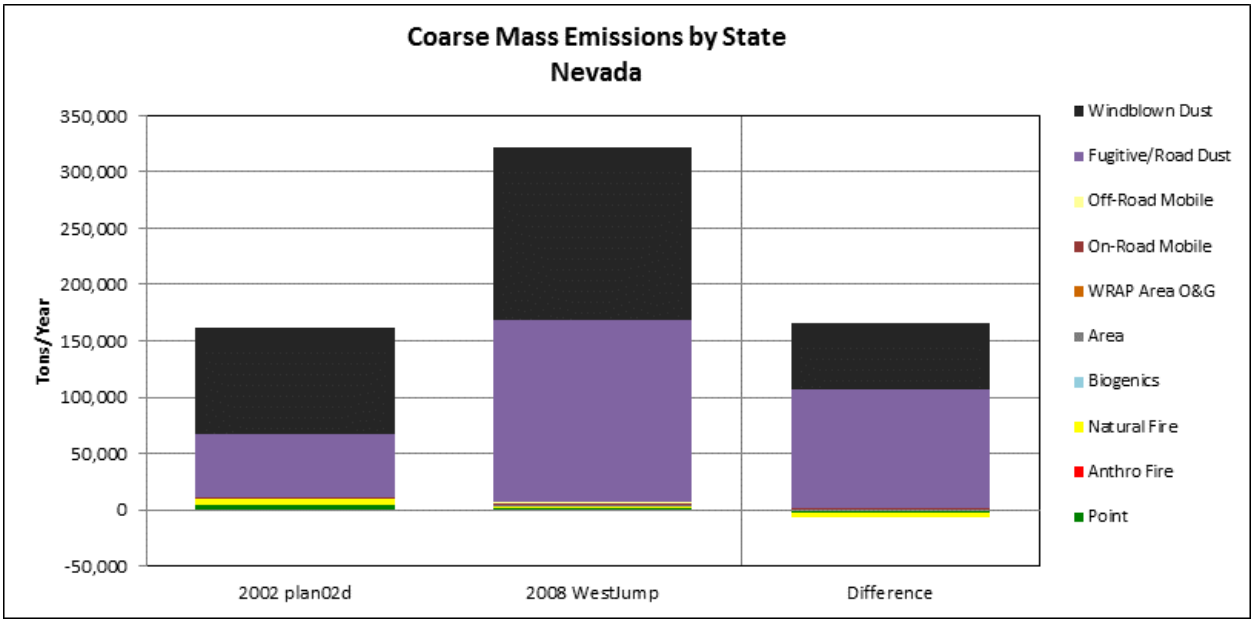
Table 5-15. Coarse Mass Emissions by Category

Source Category	Coarse Mass Emissions (tons/year)		
	2002 (Plan02d)	2008 (WestJump2008)	Difference (Percent Change)
Anthropogenic Sources			
Point*	4,093	1,761	-2,331
Area	897	1,094	198
On-Road Mobile	245	2,014	1,769
Off-Road Mobile	0	82	82
Area Oil and Gas	0	0	0
Fugitive and Road	56,779	161,532	104,753
Anthropogenic Fire	7	4	-3
Total Anthropogenic	62,020	166,488	104,468 (168%)
Natural Sources			
Natural Fire	5,176	1,310	-3,866
Biogenic	0	0	0
Wind Blown Dust	93,946	153,459	59,513
Total Natural	99,122	154,769	55,647 (56%)
All Sources			
Total Emissions	161,142	321,257	160,115 (99%)

*Point source data includes only oil and gas and regulated CEM sources. More comprehensive point source data were not available at the time this report was prepared but will be made available through the WRAP TSS (http://vista.cira.colostate.edu/tss/).

22 http://www.clarkcountynv.gov/Depts/AirQuality/Documents/Planning/SIP/PM10/PM10_SIP_PLAN_without_Appendices.pdf (page 3-1; last viewed 8/29/ 2014)

Figure 5-8. 2002 and 2008 Coarse Mass Emissions and Differences by Source Category



As can be seen from the tables and figures in this chapter, visibility-impairing emissions from point sources have significantly decreased with the exception of volatile organic compounds and elemental carbon. Point sources of both of these two pollutants contribute only a minor fraction of the anthropogenic emission sources.